CONCISE COMMUNICATION

Show Me the Money: Long-Term Financial Impact of an Antimicrobial Stewardship Program

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The financial impact of an antimicrobial stewardship program in operation for more than 11 years was determined by calculating the reduction in antimicrobial expenditures minus program labor costs. Depending on the method of inflation adjustment used, the program was associated with average cost savings of $920,070 to $2,064,441 per year.

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The primary goals of antimicrobial stewardship are improved clinical outcomes and reduced antimicrobial resistance. However, hospital administrators are also interested in the financial impact of such programs, since these programs require monetary support to be successful. Wake Forest Baptist Medical Center, an 880-bed academic medical center, implemented an antimicrobial stewardship program titled the Center for Antimicrobial Utilization Stewardship and Epidemiology (CAUSE) in early 2000. The program includes a staff of 2 infectious disease physicians and 3 infectious disease–trained pharmacists. Salary expenses for 0.5 full-time-equivalent physicians and 0.8 full-time-equivalent pharmacists, which represent the relative time that each discipline devotes to the program, are provided by the medical center to support the initiative. Activities performed by CAUSE are very similar to those described in the guidelines by Dellit et al[1] and include formulary restriction with preauthorization and prospective audit with intervention and feedback. The programmatic aspects of CAUSE have been reported previously,[2] and a complete description of the program can be found at http://www.wakehealth.edu/School/CAUSE/CAUSE.htm. This article describes the long-term impact of this program on antimicrobial expenditures.

METHODS

Antimicrobial expenditures per patient-day (AE/pt-day) is a financial metric that is routinely measured at our facility. Antimicrobial expenditures are directly calculated from the electronic medical record for all anti-infective doses administered to inpatients multiplied by the acquisition cost of each dose. This figure is divided by the number of inpatient days to determine AE/pt-day. To try to predict what this metric would have been without the influence of our stewardship program, a "baseline" AE/pt-day was calculated for the 6 months before the implementation of CAUSE (October 1999–March 2000). This baseline figure was then adjusted from April 2000 through June 2011 using 2 different methods to account for inflation. In method A, the adjustment used the annual US consumer price index for medical care commodities.[3] This index, which includes medicinal drugs and medical equipment and supplies, is the one that is most specific for medications. In method B, the inflation rate was taken from a series of articles published annually from 2002 to 2011 that analyzed medication costs and predicted future expenditures for the coming year.[4,5] These articles provided a rate of change that was specific for systemic anti-infectives used in nonfederal hospitals for each year from 2001 to 2009. The following assumptions were made to establish a rate to use for the 3 years when the articles did not provide an anti-infective-specific rate (2000, 2010, and 2011). We used the rate for 2000 that was documented for all drugs for nonfederal hospitals during that year (6.1%). The authors provided a rate for the first 9 months of 2010 (−2.4%); this was used in our equations as the rate for the entire year. The investigators predicted an increase of 1%–3% for all hospital drug expenditures for 2011. We used the lower figure (1%) in our calculations for 2011. For both methods, the prior year's AE/pt-day was multiplied by 1 plus the method's corresponding inflation rate. Data for the years that did not include a full 12 months (2000 and 2011) were adjusted accordingly. Annual adjustment factors ranged from 1.4% to 4.0% for method A and from −3.9% to 17% for method B.

For each year, the difference between the anticipated and the actual AE/pt-day was multiplied by the number of patient-days for the year. This provided an estimate of the actual reduction in antimicrobial expenditures. To account for the labor costs of the program, the salary and benefit expenses for the physician and pharmacist for the specific year were totaled and then subtracted from the antimicrobial expenditures savings. This provided a measurable estimate of the financial impact of CAUSE. The calculations are summarized by the following equation:

$$\text{annual savings} = [(\text{AE/pt-day}_{\text{anticipated}} - \text{AE/pt-day}_{\text{actual}}) \times \text{pt-days}] - \text{labor costs}.$$

RESULTS

The actual and the anticipated AE/pt-day since the implementation of CAUSE are presented in Figure 1. At all data points, the actual AE/pt-day was less than what would have been anticipated on the basis of either prediction method. Even after accounting for the labor expenses of the program, the

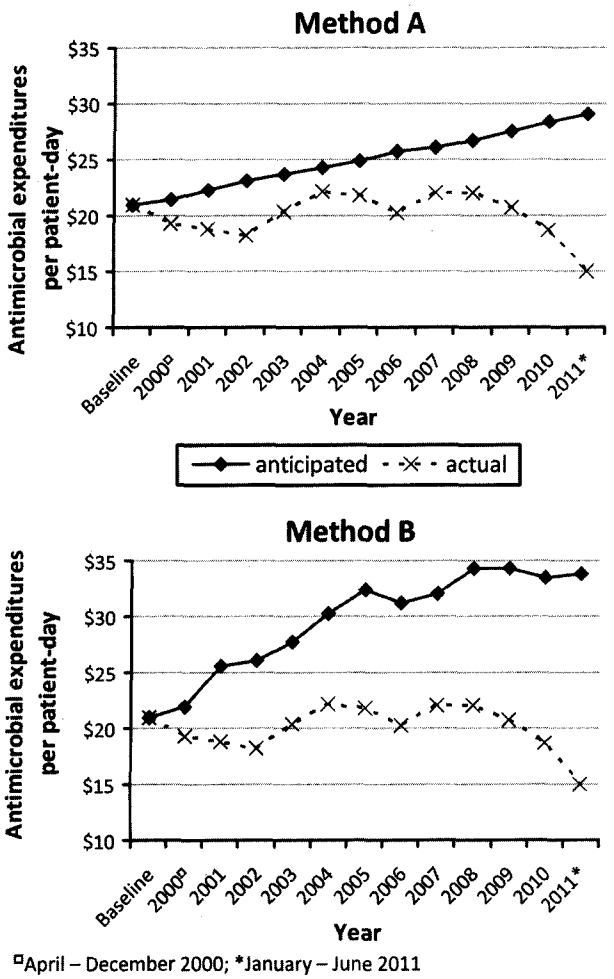

FIGURE 1. Comparison of anticipated versus actual antimicrobial expenditures per patient-day since the implementation of an antimicrobial stewardship program titled the Center for Antimicrobial Utilization Stewardship and Epidemiology, determined using an inflation rate based on the US consumer price index for medical care commodities (method A) and an anti-infective-specific index (method B).

annual savings are still quite substantial. As presented in Table 1, the annual savings increased throughout most years of the study period, especially during recent years, when our actual AE/pt-day decreased dramatically. Annual savings ranged from $158,161 to $2,175,927 (average, $920,070) by method A and from $229,076 to $3,456,373 (average, $2,064,441) by method B. Total savings over the 11 and a quarter years of our program is $10,350,787 and $23,224,961 by methods A and B, respectively. During this period, our average annual antimicrobial expenditures were approximately $4.5 million.

DISCUSSION

To our knowledge, this study encompasses the longest period that has been analyzed to determine the financial impact of an antimicrobial stewardship program. Since it is relatively easy for an institution to measure what it spends on antibiotics, metrics related to antimicrobial expenditures (such as AE/pt-day) are often used as a quantifiable indication of the economic impact of a stewardship program. It is impossible to accurately predict what our expenditures would have been if we had not implemented CAUSE. Our approach to estimate these expenditures was to take our baseline AE/pt-day and adjust it on the basis of various inflation factors. Since the most accurate way to do this has not been established, we used 2 different methods to estimate expenditures in the absence of CAUSE. Antimicrobial expenditures are influenced by factors beyond simple inflation, such as the release of new high-priced agents, new guidelines recommending changes in antibiotic usage, and the availability of generic products. Therefore, method B may be a more accurate means of predicting what our expenditures would have been without the influence of our stewardship program.

Unfortunately, some antimicrobial stewardship programs may feel pressure to justify their existence through a reduction in antibiotic spending. Although stewardship programs are usually associated with a decrease in antimicrobial expenditures,[1] it is important for all to be aware of the positive economic impact of stewardship programs that go beyond what is spent on antibiotics.[6] These include effects on reducing intensive care unit and hospital length of stay, minimizing antibiotic resistance, and improving adequacy of empiric therapy.[7,8]

Throughout its more than 11 years of existence, our stewardship program has been associated with a dramatic reduc-

TABLE 1. Summary of Annual Savings Associated with the Implementation of the Center for Antimicrobial Utilization Stewardship and Epidemiology, Determined Using an Inflation Rate Based on the US Consumer Price Index for Medical Care Commodities (Method A) and an Anti-Infective-Specific Index (Method B)

Year	Method A	Method B
2000[a]	158,161	229,076
2001	548,002	1,267,638
2002	806,393	1,446,883
2003	473,174	1,354,129
2004	244,160	1,555,048
2005	419,613	2,005,202
2006	983,690	2,172,756
2007	675,036	1,990,967
2008	817,503	2,557,972
2009	1,278,301	2,782,519
2010	2,175,927	3,456,373
2011[b]	1,770,827	2,406,399
Yearly average	920,070	2,064,441
Total savings	10,350,787	23,224,961

NOTE. Data are US dollars.
[a] April–December 2000.
[b] January–June 2011.

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tion in antimicrobial expenditures. This translates into measurable savings well beyond the salary expenses required to support the program. Although the goals of our stewardship program are primarily clinical in nature, we have demonstrated that a stewardship program can provide sustainable financial benefit for the institution. Healthcare system administrators should be aware of the potential positive economic impact of an antimicrobial stewardship program so that these essential programs receive the necessary financial support.

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